

S. J. Greenfield

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Congenital Malformation of  
the Aortic Valves

by

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[<sup>y</sup>Trans. Path. Soc. 1895. 6. xxvii]



1. *Congenital malformation of the aortic valves, consisting in the existence of only two segments.*

By W. S. GREENFIELD, M.D.

THIS case was one of an abnormal condition of the aortic valves, resulting from defective development, and consisted in the existence of only two instead of three semilunar segments.

The heart was removed from a man 68 years of age, who was admitted to St. Thomas's Hospital on December 28th, 1875, under the care of Mr. Mac Cormac, for severe accidental injuries, from the shock of which he died on December 31st.

*Post-mortem, twenty-six hours after death.*—Body of a strongly built muscular man. (The conditions due to the injury need not be detailed.)

*Lungs.*—Right weighed 29 oz. ; left 25 oz. Both emphysematous at the upper part, much congested posteriorly and at the base.

*Liver* weighed 67 oz., slightly fatty, otherwise normal.

*Spleen* weighed 9 oz., was large, somewhat pale and soft ; on section, the pulp, greasy and soft, easily washed away.

*Kidneys.*—Right of normal size, weighing  $6\frac{1}{2}$  ounces, capsule somewhat adherent, organ of generally somewhat fatty appearance ; cortex slightly wasted. Left, contained two large thin-walled cysts, measuring 3 and  $4\frac{1}{2}$  inches in diameter respectively, containing clear yellowish, watery fluid ; there were some other smaller cysts, and the renal substance was much atrophied.

*Brain* weighed 49 oz. Extreme atheroma of both internal carotids, the right being nearly occluded. General atrophy of brain-substance, with some thickening and opacity of arachnoid.

*Heart* of large size, weighing, after removal of coagula, exactly 16 ounces. The right auricle was distended by a mass of recent clot, and the right ventricle also contained a mass of coagulum, which extended into the pulmonary artery. The left side contained only a small quantity of clot. The enlargement of the heart was general, and did not appear to affect specially any particular

part, all the cavities being somewhat dilated and their walls thickened.

Right auricle, endocardium opaque, some dilatation. A well-marked fossa ovalis with a communication which readily admits a probe to the left auricle.

Right auriculo-ventricular orifice normal, measuring 14 centimètres ( $5\frac{1}{2}$  inches) in circumference. Tricuspid valve normal. Right ventricle slightly dilated and its wall a little thicker than normal. Pulmonary valves normal in size and situation; slight atheroma of pulmonary artery at its bifurcation.

Left auricle somewhat dilated, but not notably so. Left auriculo-ventricular orifice measured 12·8 centimètres (5 inches) in circumference. Mitral valve had some slight thickening at its free border. Left ventricle slightly dilated, the cavity measuring 7 centimètres ( $2\frac{3}{4}$  inches) in length along its posterior wall. The wall of the ventricle measured from  $\frac{1}{2}$  to  $\frac{5}{8}$  inch in thickness at its thickest part near the septum, and the muscular tissue was extremely fatty and friable. Aortic valves appeared to close well, but were not very carefully tested.

The aortic valve was found to consist of only two segments, situated respectively anteriorly and posteriorly. The segments were of nearly equal size, the posterior being apparently slightly the larger of the two; they met well in the middle line, but the sinuses of Valsalva were considerably dilated, especially the posterior. The posterior segment was apparently normal, though considerably larger than natural, its free margin measuring  $5\frac{1}{4}$  centimètres in width. There was some atheromatous thickening at the attached border, and the valve was generally somewhat thick and opaque. The anterior segment evidently represented the normal right and left anterior semilunar segments; it was of nearly equal size with the posterior, and of similar shape, but nearly at its centre a narrow ridge or spur was found running from near its attached border on to the wall of the aorta. This ridge, however, did not extend to the free margin of the valve, which was uniform, and shewed no sign of a division. The sinus of Valsalva was considerably pouched, but only a very slight groove existed on each side of the ridge before mentioned. Both the right and the left coronary arteries sprang from this sinus, one near each extremity. The ridge which indicated the position of the adjacent edges of the normal right and left anterior segments occupied the usual situation, opposite the ridge between

the right and left posterior segments of the pulmonary valve. There was some atheroma and calcification at the base of the anterior segment. The aorta was considerably dilated in the ascending part of the arch, measuring  $14\frac{1}{4}$  centimètres ( $5\frac{3}{4}$  inches) in circumference at a distance of one inch above the valves.

The specimen is one of a form of malformation which has been especially studied by Dr. Peacock, who has recorded several instances in the 'Transactions' of the Society and elsewhere.

The condition, no doubt, originates during the course of development, probably by the growing together of the adjacent margins of the segments at a very early period. In this case the perfect adaptation of the valves to the closure of the orifice, and the accommodation of the posterior segment to the abnormal size and shape of the other segment would seem to indicate that the change was entirely developmental, and in no sense the result of inflammatory adhesion. A similar condition may, no doubt, originate in endocarditis occurring during infancy; but in all probability there is usually in such cases either stenosis or imperfect adaptation of the segments, or a growth of vegetations, which conditions give rise sooner or later to some symptoms. The entire absence of any history of cardiac affection in the present case, coupled with the fact that the general enlargement of the heart is fully accounted for by senile changes and by the condition of the kidneys, goes far to prove that no ill effects resulted from the malformation. *January 4th, 1876.*

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## 2. *Double mitral valve.*

By W. S. GREENFIELD, M.D.

THE specimen exhibited, which was removed from the body of a man 28 years of age, who was under the care of Dr. Bristowe, and died from the results of acute myelitis, is an example of a curious malformation of which I can find no other instance on record. There was no evidence either in the clinical history or in the condition of the organs after death that the malformation gave rise to any pathological results.

The heart was of somewhat, but not notably large size; externally its appearance was normal, and the valves, on testing with a stream of water, closed perfectly. But on looking at the mitral valve on the auricular aspect, two distinct orifices, of unequal size, were seen to exist. Whilst at rest the smaller orifice appeared as if it were an irregular opening in one of the curtains, produced by rupture, but on passing a stream of water into the ventricle this smaller orifice as well as the larger was found to close perfectly by small curtains. The smaller orifice was about half an inch in diameter, and of rounded shape. Whilst in action this valve came up to the same level as the other, during diastole falling back against the wall of the ventricle.

On inspection from the ventricular aspect, it became evident that the mitral valve was divided into two unequal halves, apparently by developmental adhesion between the two curtains at one point, each of the two portions being provided with distinct chordæ tendineæ, and forming a complete valve in itself. The smaller valve, situated anteriorly and to the left, received its chordæ tendineæ entirely from the small anterior musculus papillaris; whilst the posterior and larger valve was entirely supplied by chordæ tendineæ from the large fleshy bundles on the posterior wall of the ventricle. There was an entire absence of thickening or other sign of old disease about the valves; the curtains were perfectly translucent and healthy looking. The upper surface of what must be called the septal portion was smooth, and sloped gently down on both sides, so that no obstruction to the



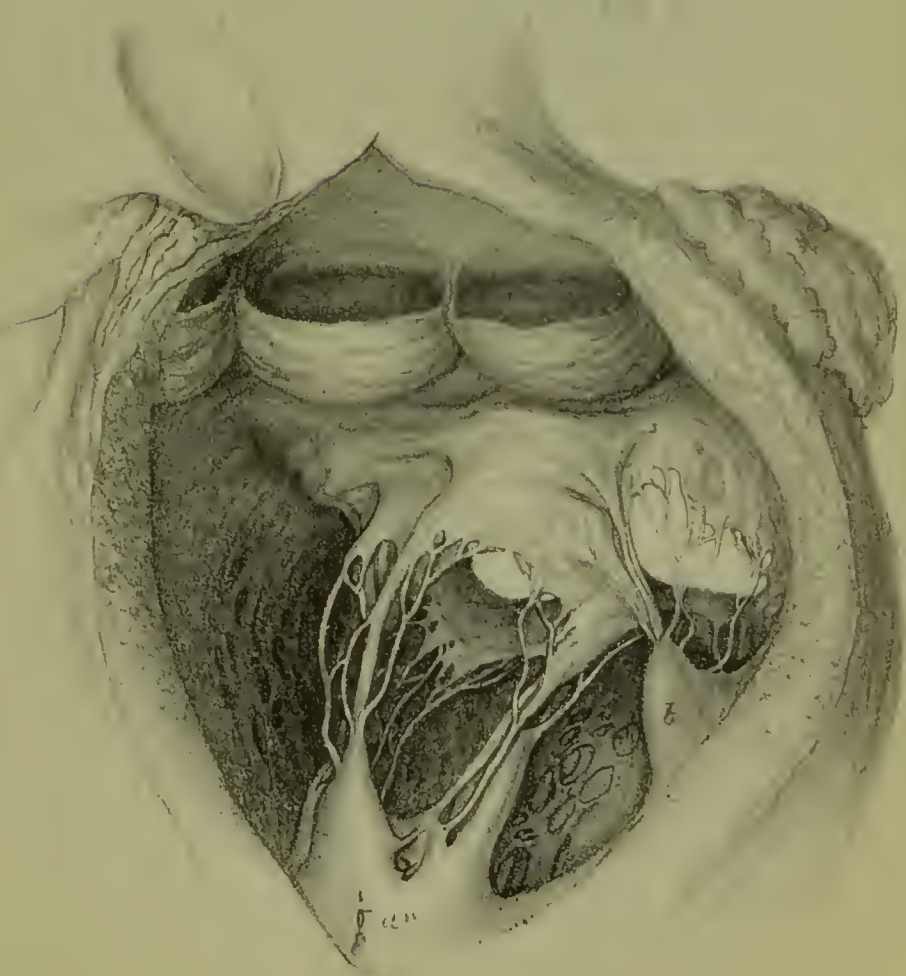
## DESCRIPTION OF PLATE IV.

Plate IV illustrates Dr. Greenfield's case of Double Mitral Valve. (Page 128.) From drawings by Mr. G. Burgess.

FIG. 1. Seen from the auricle.

2. This shows the cavity of the left ventricle laid open in front by an incision near the septum. The larger valve is seen receiving chordæ tendineæ from posterior musculi papillaris *a*, the smaller from anterior *b*. (The smaller orifice appears much larger than in the fresh condition, the valve having been necessarily stretched in the process of preserving the specimen.)







flow of the blood current appeared to be produced by it. Moreover, there were none of the associated lesions of mitral stenosis.

I can suggest no other hypothesis of the mode of development of this malformation than that of an adhesion at a very early period of the growth of the organ.

The drawings show respectively the views of the valve from the auricular and ventricular aspects. (*Vide* Plate, figs. 1 and 2.)

*May 2nd, 1876.*

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3. *Persistence of left vena cava superior, with absence of right.*

By W. S. GREENFIELD, M.D.

THE specimen exhibited affords an instance of an abnormal mode of development of the great venous trunks, consisting in the persistence of the left instead of the right duct of Cuvier as the main channel for the conveyance of the venous blood from the head and upper limbs to the right auricle. It will be remembered that early in foetal life the blood from the right and left brachiocephalic trunks respectively is separately conveyed to the right auricle by the right and left "ducts of Cuvier;" subsequently a transverse branch is formed, connecting the left brachiocephalic with the right, and the right duct of Cuvier forms the normal vena cava superior in man. The left is partially obliterated, its lower portion persisting as the coronary sinus, whilst the upper forms the oblique vein, the intermediate portion producing the "vestigial fold" of Marshall. Minor details may be omitted, and the reader referred to Mr. Marshall's memoir for a full account of the mode of development.<sup>1</sup> In some cases both ducts of Cuvier persist, and a "double" vena cava superior is thus formed, the blood from each brachiocephalic trunk entering the heart separately, or in some cases a larger or smaller transverse trunk connecting the two.

In the present case the left trunk alone appears to have persisted, the right opening into it; the right, if persistent, which is doubtful, being represented by only a very small vein: the usual condition being thus reversed, and the whole of the venous blood from the upper extremities and head entering the right auricle by the coronary sinus.

How far this condition influenced the course of the symptoms must be judged from the clinical history, for which and for the opportunity of bringing the case before the notice of the Society I am indebted to Dr. Stone, under whose care the patient was.

J. J. M—, æt. 39, a butcher; admitted January 5th, 1876; died January 23rd. He stated that he had been subject to slight winter

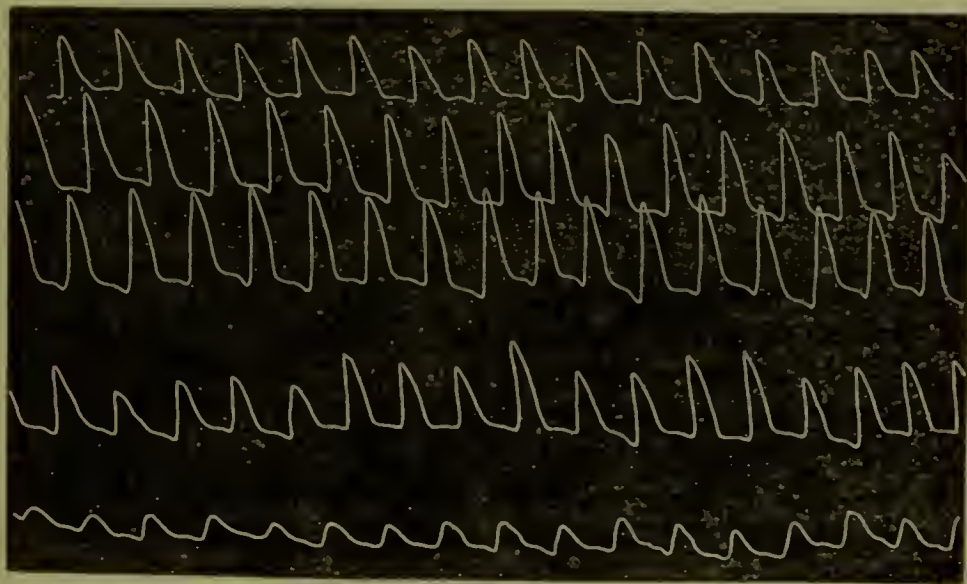
<sup>1</sup> "On the Development of the Great Anterior Veins in Man and Mammalia," by John Marshall, F.R.S. 'Philosophical Transactions,' Part I, 1850.

cough for some time, but had been really ill for only eight weeks, at which period he was suddenly seized with cough, and had since that time occasionally spat streaks of blood on coughing. He had been very short of breath since his attack, and for six weeks his feet had been swollen. Had never suffered from rheumatic fever or other serious illness. He had been in the habit of drinking pretty freely beer, rum, and whisky.

On admission, there was extreme dyspnœa, face livid, expression anxious, breathing rapid, inability to lie on the left side. Legs very œdematous, bedsores over sacrum and heels. Loud crepitation and bronchitic râles all over the chest. Heart-sounds feeble, no murmur. Tongue clean, bowels regular. Urine scanty, free from albumen.

January 10th.—General condition much improved. On examining the heart it appears to be hypertrophied, but overlapped by the emphysematous lungs. A somewhat doubtful systolic murmur is heard over the base of the heart. Pulse very regurgitant.

WOODCUT 1.



No further notes are to be found, but the dyspnœa and other symptoms gradually increased, the patient ultimately dying on January 23rd from erysipelas and gangrene induced by acupuncture for the dropsy of the legs.

The tracings of the pulse (*vide* Woodcut 1), and the other symptoms, led Dr. Stone to the belief that there was probably some obstruction of one of the large venous trunks.



*Post-mortem*.—Body stout; great œdema of both lower limbs, with thickening of the skin as from chronic congestion; gangrene of left leg as high as the knee, and inflammatory œdema over front of left thigh. The peritoneum contains about 8 pints of clear serous fluid, the right pleura  $2\frac{1}{2}$  pints, and the left  $1\frac{1}{2}$  pints.

The *pericardium* contains about  $1\frac{1}{2}$  oz. of turbid serum, and there are adhesions over a great part of its anterior surface by recent lymph.

*Heart* large, weighing  $22\frac{1}{2}$  oz.; circumference at base of ventricles 13 inches; the right semi-circumference 7 inches, the left 6 inches; left ventricle 5 inches in length, large, with rounded apex.

The right auricle small as to its body, but the appendix much distended.

The heart was unfortunately removed before the relation of the great vessels was traced, the following description being the result of such investigation as was possible afterwards.

The inferior cava opened into the right auricle in the usual situation, but further forwards and at a somewhat higher level than usual. The orifice for superior cava was completely absent, and the corresponding elongation upwards of the body of the auricle did not exist, so that the auricle appeared flattened and truncated at its upper part, the lower part and appendix being correspondingly increased in size. A small orifice, the size of a crowquill, was found close to but to the outer side of the orifice of the vena cava inferior, but no other external aperture could be discovered, and the relations of this opening could not be traced. On opening the auricle in front an orifice of large size was seen in the position of the entrance of the coronary sinus, which was situated just posterior to and below the opening of the vena cava inferior, a small and imperfectly developed Thebesian valve existing at its lower part. This enormously dilated coronary sinus and vein, passing round in the usual situation, was continued upwards by a large venous trunk lying in front of the pulmonary artery to the vessel formed by the junction of the left jugular and subclavian veins; the right jugular and subclavian, uniting in the usual manner, passed obliquely to the left, joining the left brachiocephalic trunk.

A small vein opened into the right brachiocephalic near its lower part, but its exact relations could not be determined. From its position it seemed probable that it represented the vena azygos major, but the azygos and superior intercostal veins could not be traced.



The woodcuts are intended to represent, in a somewhat diagrammatic manner, the condition of the vessels (*vide* Woodcuts 2 and 3), fig. 1 being taken from Mr. Marshall's paper, to show the persistence of both anterior primitive veins, for the sake of comparison.

WOODCUTS 2 & 3.

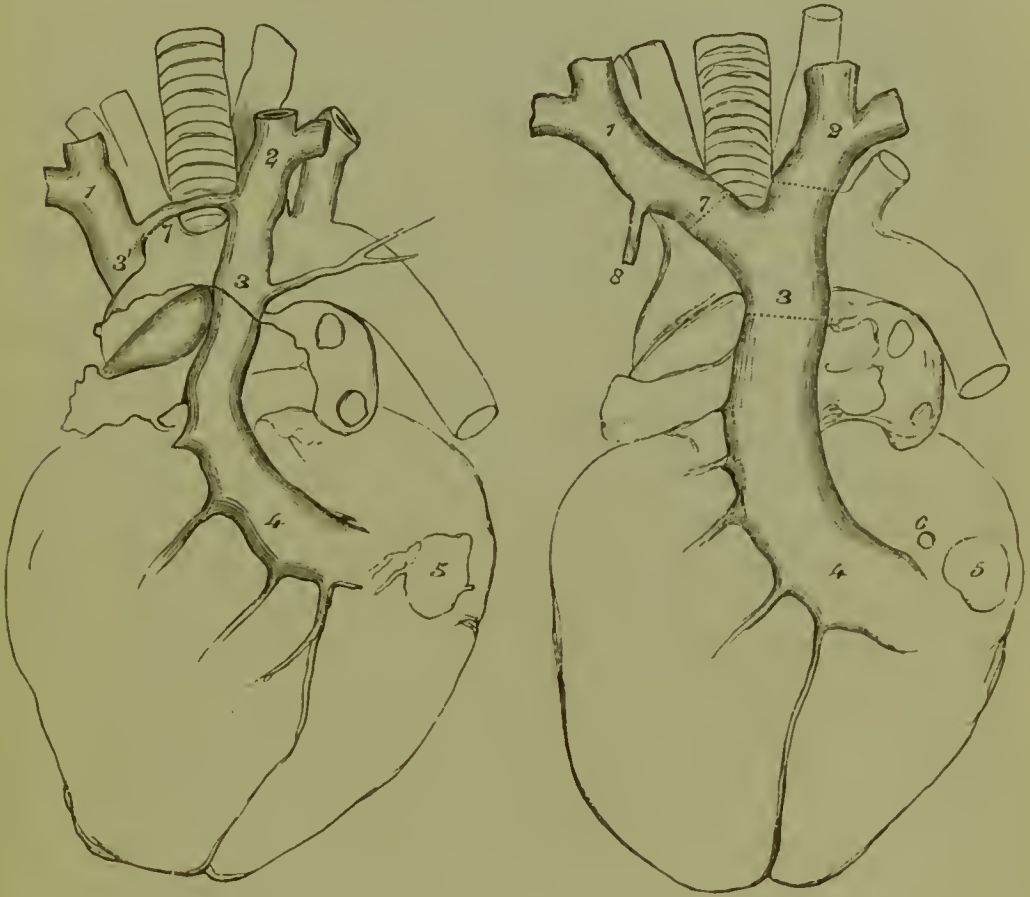


FIG. 1.

FIG. 2.

Semi-diagrammatic sketch to show relations of great vessels. Fig. 1, taken from Mr. Marshall's paper, to show persistence of *both* ducts of Cuvier. Fig. 2, from case of J. J. M—, showing persistence of *left* only. (About one third of natural size.)

1, Right, 2, Left brachio-cephalic vein. 3, Left, 3', Right vena cava superior. 4. Coronary sinus. 5. Opening of vena cava inferior. 6. Small orifice, the relations of which were doubtful (? azygos vein). 7. Transverse communicating branch.

The heart is viewed from the left and posterior aspect.

The dotted lines in fig. 2 indicate the point at which the vessels were accidentally cut before examination.

The veins of the neck were enormously distended with fluid

blood. Right ventricle large, its walls thick. Left auricle large, funnel-shaped. Endocardium opaque. Mitral valve normal. Left ventricle dilated and hypertrophied. Aortic valves close imperfectly under a stream of water. Aorta extremely atheromatous and rigid throughout, the inner surface of the vessel resembling the bark of an oak tree.

Lungs extremely emphysematous, bronchi with signs of chronic congestion. Liver normal. Spleen somewhat congested. Kidneys large, firm, with very distinct and prominent Malpighian tufts; capsule slightly adherent.

Nothing else abnormal of note in the viscera.

Taking into consideration the other morbid conditions, it seems to me very questionable whether the abnormal condition of the vena cava had any influence in the production or on the course of the symptoms.

In two ways only can it be supposed that venous obstruction may have resulted in some degree. The passage of the blood along the coronary vein and sinus was necessarily less direct than usual, and from the fact that it must pass round the back of the heart, it is not improbable that when the heart was enlarged some compression might be exerted upon the vessel against the spine. Possibly, too, the direction of the blood-current in the auricle might prejudicially affect the return from the inferior cava. But I should be unwilling to ascribe much importance to either of these factors.

*April 4th, 1876.*

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#### 4. *Stenosis of the tricuspid and mitral valves.*

By W. S. GREENFIELD, M.D.

**S**TENOSIS of the right auriculo-ventricular orifice or of the tricuspid valve is a condition of great rarity, so far as can be judged by the number of recorded cases, and its detection during life is usually considered almost if not quite impossible. Dr. Flint, in his work on 'Diseases of the Heart,' states that a tricuspid direct murmur is one of the rare curiosities of medical experience; and Niemeyer remarks that stenosis of the tricuspid is extraordinarily rare. The majority of recent writers on diseases of the heart scarcely mention it. Dr. Hayden<sup>1</sup> has collected fifteen recorded cases, three of which have come under his own observation. In the 'Transactions' of this Society only three cases are on record, one in vol. i (1848), by Mr. Quain; another in vol. ii (1850), by Mr. Pollock; and a third in vol. iii (1852), by Mr. Pye Smith, since which no case has been brought forward. In the 'Transactions' of the Pathological Society of Dublin six cases are reported. According to Dr. Hayden, in all of the fifteen cases save one the stenosis of the tricuspid was associated with a similar condition of the mitral valve.

The present case offered some other features of interest in their bearing on the questions as to how far the condition of the heart may have been concerned in the fatal issue, and whether syphilis may have had anything to do with its production; it may, therefore, be narrated in some detail.

Caroline N—, æt. 43, married, no children, was admitted under the care of Dr. Stone, on November 5th, 1875. She says she has had very good health; never had rheumatic fever. She had two miscarriages nineteen years ago, and has suffered from "fits" for twenty years. No history of any symptoms of syphilis can be elicited on careful inquiry. Two months ago she had a slight attack of bronchitis, and some vomiting after food. She has lately had some œdema of the face and legs, and pain in the chest, but no cough. A fortnight ago she got out of bed at about 5.30 a.m., and after doing so fell on the floor; on attempting to rise she found that she had lost the use of the left arm. There was no loss

<sup>1</sup> 'On Diseases of the Heart,' Dublin, 1875.

of consciousness, and no convulsions, and she states that she could move the leg freely after the seizure. There was impairment of speech for three or four days; and a pain in the back of the head which came on at the time lasted for three or four days.

The patient came to the hospital to apply for admission, walked there, got an order for admission, went away, came again in the evening, and walked to her bed.

*State on admission, November 5th.*—There is no loss of consciousness or of sensation; speaks well. There is complete paralysis of the left arm, incomplete of the left leg; the tongue is directed to the left and the left upper lip droops, but there is no distortion of the mouth. Pupils equal. Pulse 96, very small and irregular; temperature, (evening), 98° F.

The heart is evidently enlarged, cardiac dulness increased in width; apex 5 inches from the middle line, in the fifth interspace. Action irregular; thrill at apex. A short rough systolic murmur is audible over the base, and a loud somewhat rough præ systolic murmur at the apex and just within it.

Urine, sp. gr. 1020, cloudy; faintly alkaline, no albumen.

November 7th.—Got up as usual this morning to have her bed made, and said she felt quite well. At 9.30 a.m., whilst in bed, she became suddenly convulsed, the right side being chiefly affected, and then comatose. On going to her the house physician, Mr. Rossiter (by whom these notes were taken), found her quite unconscious, breathing stertorously; face congested and livid; pupils contracted to the size of pinholes; conjunctiva insensible; foaming at the mouth. The head was turned to the right; no rigidity or twitching of limbs. Heart's action tumultuous, loud rhonchi all over the chest; pulse hardly perceptible. Mustard and linseed poultice was applied to nape of neck; calomel 5 grains; Ol. Crotonis ℥j, Enema Sennæ Co. The enema was returned, the croton oil was repeated three times without effect.

10.30 a.m. Looks rather better; face less congested. Still comatose.

2.30 p.m. Had another convulsive attack, is now livid and comatose.

Died at 8.55 p.m.; the coma increasing until death. No rigidity of limbs.

*Post-mortem examination twelve hours after death.*—Weather cold. Body somewhat wasted. No scars on legs. No nodes on tibiæ.

*Pericardium normal.*



*Heart* weighs 13 ounces. Looking at the organ from the front there appears a marked disproportion in the size of the right and left ventricles. The right, which is of large size and normal shape, projects considerably beyond the left at the apex; the left, which is very small, appearing only half the length of the right. The *right auricle* is of large size, and somewhat conical shape, the appendix distended. The *right auriculo-ventricular orifice* is greatly narrowed by the adhesion of the margins of the curtains of the valve, so as to produce a somewhat half-moon-shaped orifice, measuring 22 millimètres (nearly 1 inch) in length, and 13 millimètres (half an inch) in width. [It should be stated that these measurements were not made until after distension of the cavities, and are therefore larger than in the fresh state.] The margins of the orifice are free from thickening and vegetations, the edge is sharp, and shows no sign of having been produced by inflammatory adhesion. The chordæ tendineæ are normal. *Right auricle* somewhat dilated, its wall thicker than normal. *Left auricle* enormously dilated, of oblong shape in its upper two thirds, conical below; the wall greatly thickened, nearly 4 millimètres thick, endocardium thick and opaque. Appendix greatly distended, forming a separate cavity with a somewhat narrow orifice, and extending downwards in front, so as to overlap the upper part of the ventricle. *Left auriculo-ventricular orifice* greatly narrowed by the adhesion of the curtains of the mitral valve, leaving only a rigid ovalish aperture, into which only the tip of the forefinger can be passed, and which measures only 18 by 7 millimètres in width. This orifice does not, however, lead directly into the ventricle, but into a funnel-shaped space formed by the coalescence of the chordæ tendineæ and the curtains, which are also adherent to the wall of the ventricle, a narrower orifice opening towards the wall of the ventricle at its lower part. Seen from below, the chordæ tendineæ and valve curtains appear fused into a solid semicartilaginous mass. The cavity of the ventricle is very small, and its walls thin. Aortic orifice normal, though apparently small, valves free from disease.

*Lungs*.—R. 15 oz., L. 14 oz., both somewhat emphysematous. Bronchi deeply congested, with signs of chronic inflammation. Posterior parts of both lungs of somewhat red colour, exuding bloody fluid on squeezing; but for the most part normal, and free from signs of old or recent congestion.

*Pleuræ*.—Right, normal. Left, with general, moderately tough cellular adhesions.

*Liver*.—Weight 2 lb. 14½ oz. Some adhesions of capsule to diaphragm. Over the surface of the liver, especially on the upper surface of the right lobe, are numerous deeply puckered and depressed cicatrices, typically syphilitic, and there are others also on the under surface of both lobes.

*Spleen*.—Weight, 7½ oz. Firm, tough, of deep red colour, as from chronic congestion, free from infarcts.

*Kidneys*.—Weight, 7 oz., small, capsule adherent, cortex wasted, very tough, surface somewhat granular, with some depressed cicatrices, apparently due to old infarcts.

*Brain*.—Dura mater opaque and thickened over vertex, sinuses normal. Superficial veins nearly empty, pia mater generally pale.

*Vessels at base*.—Both internal carotids somewhat rigid at their termination, left posterior communicating artery of remarkably small size. Internal carotid, middle cerebral, anterior cerebral, and posterior communicating arteries free from thrombosis. The basilar artery is filled by a firm dark thrombus in its anterior two thirds, the clot being apparently of quite recent origin, although formed before death. This clot extends into the left posterior cerebral artery, but only into that portion posterior to the junction of the posterior communicating artery. The left superior cerebellar artery, which is represented by two branches arising from the posterior cerebral close to the basilar, is completely blocked by coagulum. The outer two-fifths of the upper surface of the left hemisphere of the cerebellum is of dark mulberry-red colour, somewhat softened, and surrounded by a narrow zone of whiter colour.

Sections of the hemispheres show nothing abnormal above the level of the corpus callosum. Over the anterior and outer part of the roof of the right ventricle is a slight induration of the white substance. The anterior two thirds of the nucleus caudatus, with the anterior and upper part of the optic thalamus, are softened, of yellow colour and broken down; the right ventricle contains yellowish, slightly turbid fluid.

The condition of the other organs presents nothing abnormal.

*Remarks*.—The entire absence of symptoms pointing to the existence of such extensive disease of the heart-valves, which must have existed for a long period, is a point of interest. Moreover, the other viscera showed but scanty evidence of the influence of cardiac embarrassment. Stenosis of the mitral valve, to an advanced degree, seems to be often compatible with the enjoyment of good health, to judge



from the frequency with which it is found, *post-mortem*, in the bodies of those who have not been suspected to suffer from heart disease. Nor does there seem to be anything in a moderate degree of tricuspid stenosis which could in any way increase the tendency to the production of symptoms. Indeed, it might be maintained with some reason that its existence, by equalising the circulation in the ventricles, although it might impede the general circulation, would tend to prevent engorgement of the lungs, and might therefore even have a beneficial influence on the general course of the disease.

The cause and the date of the disease seem very doubtful. The tricuspid stenosis had much the appearance of a congenital condition; but, from a comparison with other cases, I am inclined to suggest the possibility that the syphilis, which existed at some period, as is shown by the condition of the liver, may have been its cause.

The condition of the tricuspid valve was not diagnosed during life. The rough præ systolic mitral murmur may have been blended with the tricuspid murmur, but this I do not think likely, as the murmur heard was very localised. But it must be borne in mind that, the right ventricle being much enlarged and completely covering the left, the murmur heard may have been a tricuspid direct murmur. I am inclined to believe that the systolic murmur at the base was an auricular appendix friction murmur, as no other condition was found which could account for it. But is it possible that a tricuspid direct murmur might be heard in that situation? Had the patient been under observation for a longer period, and when in a better state of health, these points might have been ascertained. As to the possibility of a tricuspid direct murmur being distinguished from a mitral direct, where both are present, which has been denied, it need only be said that the diagnosis has been correctly made by Dr. Haldane and I believe also by Dr. Gairdner.

There remains the question whether the thrombosis of the cerebral arteries was due to the embarrassed action of the heart. I am rather disposed to believe that it depended on disease of the vessel of syphilitic origin, as the latter is so often the cause of multiple thromboses.

The rapidly fatal issue was probably due to the cutting off of the supply of blood to the pons by the plugging of the basilar artery, and the extreme contraction of the pupils is, from this point of view, a fact to be noticed.

January 18th, 1876.

